Fundamental Equations of State – A Tool for the Future? (Invited)

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Fundamental equations of state have been used since the early 1970‘s for the accurate and consistent representation of all thermodynamic properties of pure fluids. Their application to mixtures was successfully developed not before the early 1990‘s. However, successful establishment of multi-parameter expressions is restricted to fluids or fluid mixtures for which experimental data of superior accuracy and large number are available. Therefore, their applicability has been up to now restricted to those fluids or fluid systems for which these data requirements are fulfilled. It is obvious that also in the future their applicability is limited under these aspects since measurements of thermodynamic data are time-consuming and expensive and, therefore, will be limited only to certain fluids or fluid systems of interest.

The present paper briefly reconsiders some of highlights in this field during the last two decades covering not only fundamental equations of state for certain fluids but also improvements in optimization procedures achieved. Moreover, some aspects will be presented how fundamental equations can be applied to equlibria involving more than one liquid phase as well as solid phases not only for pure fluids but also for mixtures. An additional aspect will be an attempt to derive a group contribution method for fundmental equations of state applicable to groups of fluids and multi-component mixtures. Although being purely empirical in nature, such applications may be suited to make fundamental equations of state a useful tool also in the near future.